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Attorneys for Defendant  
Teck Cominco Alaska Incorporated

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF ALASKA AT ANCHORAGE

ENOCH ADAMS, JR., LEROY ADAMS,	)	
ANDREW KOENIG, JERRY NORTON,	)	
DAVID SWAN AND JOSEPH SWAN,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Case No. A04-49 CV (JWS)
	)	
TECK COMINCO ALASKA	)	
INCORPORATED	)	
	)	
Defendants.	)	EXPERT REPORT ADDENDUM OF
	)	JOYCE S. TSUJI

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**I. Introduction and Summary of Opinions**

I, JOYCE S. TSUJI, under penalty of perjury under the laws of the State of Alaska,  
hereby declare that the following is true and correct:

1. This Addendum updates my previous expert report (dated November 15, 2004), based  
on additional monitoring data from the site and additional relevant site documents and data  
received after my expert report was completed. I also based this update on the current scientific

literature on the toxicity of the constituents that I was asked to address in this case, namely, cadmium, cyanide, and total dissolved solids (TDS).

2. I originally was asked to render an opinion on whether the discharge monitoring permit violations for TDS, cyanide, and cadmium from the Red Dog Mine between August 1998 and May 2003, noted by Adams et al. in their complaint against Teck Cominco, would result in human health effects or a reasonable fear of possible future disease based on the preponderance of scientific evidence. I have subsequently been asked to update my opinion to include discharge monitoring permit violations for cyanide in 1999 through 2006, and for TDS from 1999 through 2007, alleged by Adams et al. in their supplemental revised complaint.

3. The additional information reviewed supports and reinforces the opinion in my previous expert report that there is no evidence of actual human health effects, nor is there reason to conclude that future health effects would occur in local human populations because of exposure to the constituents named in the alleged permit violations.

4. I reserve the right to modify and supplement my opinions as further information becomes available, and to express new opinions in response to new information or to additional opinions expressed by plaintiffs' experts.

## **II. Qualifications**

5. An overview of my qualifications was provided in my previous expert report in this case. My current resume and project experience are included as Attachment A.

### III. Additional Information Reviewed

6. In updating my expert report, I have reviewed the following additional information:

- [Proposed] Supplemental Revised Complaint for Injunctive and Declaratory Relief and Civil Penalties, Case No. A04-49, U.S. District Court for the District of Alaska at Anchorage.
- ATSDR. 2006. ToxFAQs for cyanide. Available at [www.atsdr.cdc.gov/tfacts8.pdf](http://www.atsdr.cdc.gov/tfacts8.pdf). Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.
- ATSDR. 2006. Toxicological profile for cyanide. Available at [www.atsdr.cdc.gov/toxprofiles/tp8.pdf](http://www.atsdr.cdc.gov/toxprofiles/tp8.pdf). Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.
- Fish tissue data from the Alaska Department of Natural Resources (ADNR) and Alaska Department of Fish and Game (ADF&G).
- Horiguchi, H., E. Oguma, S. Sasaki, K. Miyamoto, Y. Ikeda, M. Machida, and F. Kayama. 2004a. Comprehensive study of the effects of age, iron deficiency, diabetes mellitus, and cadmium burden on dietary cadmium absorption in cadmium-exposed female Japanese farmers. *Toxicol. Appl. Pharmacol.* 196:114–123.
- Horiguchi, H., E. Oguma, S. Sasaki, K. Miyamoto, Y. Ikeda, M. Machida, and F. Kayama. 2004b. Dietary exposure to cadmium at close to the current provisional

tolerable weekly intake does not affect renal function among female Japanese farmers.

Environ. Res. 95:20–31.

- Horiguchi, H., E. Oguma, S. Sasaki, K. Miyamoto, Y. Ikeda, M. Machida, and F. Kayama. 2005. Environmental exposure to cadmium at a level insufficient to induce renal tubular dysfunction does not affect bone density among female Japanese farmers. Environ. Res. 97:83–92.
- Kivalina drinking water survey, spring 2005, fall 2005, fall 2006, and fall 2007, including sampling from Station 1 on the Wulik River in fall 2005.
- Memorandum of points and authorities in support of motion for leave to file supplemental complaint, Case No. A0-4-49, U.S. District Court for the District of Alaska at Anchorage.
- Middaugh, J.P., and S.M. Arnold. 2005. Public health evaluation and assessment biomonitoring in residents of Kivalina and Noatak lead and cadmium results. Alaska Division of Public Health, Section of Epidemiology.
- Ott, A.G., and W.A. Morris. 2007. Aquatic biomonitoring at Red Dog Mine, 2006. National Pollution Discharge Elimination System Permit No. AK-003865-2. Technical Report No. 07-03. Alaska Department of Natural Resources.
- Quakenbush, L., and J. Citta. 2006. Metals and organochlorine concentrations in bearded seals (*Erignathus barbatus*) harvested by subsistence hunters near Kivalina,

Alaska in 2005. Alaska Department of Fish and Game, Arctic Marine Mammal Program.

- Rudnick, D. 2005. Summary tables for Maniilaq Association fish tissue data. Memorandum to Enoch Shiedt, Maniilaq Association. Integral Consulting, Mercer Island, WA.
- Scannell, P.W. 2005. Fish tissue data from the Wulik and Kivalina Rivers. Cover letter to Alvin G. Ott, Alaska Department of Natural Resources, with Attachment: Maniilaq Fish Tissue Data, Wulik and Noatak Rivers.
- U.S. EPA. 2004. Preliminary remediation goals. [www.epa.gov/region09/waste/sfund/prg/index.html#prgtable](http://www.epa.gov/region09/waste/sfund/prg/index.html#prgtable). Accessed January 16, 2008. U.S. Environmental Protection Agency, Region 9. October.
- U.S. EPA. 2006. Drinking water standards and health advisories. 2006 Edition. EPA 822-R-06-013. U.S. Environmental Protection Agency, Office of Water, Washington, DC.
- Water quality data for the Wulik River from 1998 through 2007, and data for Outfall 001 on Red Dog Creek from 2005 through 2007.

### **III. Basis for Opinions**

#### **A. Wulik River Water Samples**

7. The focus of evaluation for potential human health effects is sampling data from Stations 1 and 2 on the Wulik River downstream of Ikalukrok Creek, which receives water from Red Dog Creek, which receives discharge from the Red Dog Mine during spring snow melt and summer rains. Ikalukrok Creek is not classified for drinking water use between its confluences with Red Dog Creek and the Wulik River because of historically elevated levels of metals prior to development of the Red Dog Mine. Station 2 on the Wulik River is located just downstream of the confluence with Ikalukrok Creek. Station 1 is 30 miles downstream of Station 2 on the Wulik River and is the location at which drinking water for the Village of Kivalina is obtained. Station 1 is thus the location of greatest human exposure.

8. As outlined in my expert report, the alleged permit violations do not constitute scientific evidence of human health risk. To assess whether human health risks may possibly be associated with discharges from the mine during the alleged violation period, a screening-level risk assessment for cadmium, cyanide, TDS, and sulfate was conducted of the Wulik River sampling data from June 1998 to September 2004. Specifically, concentrations of these constituents in water were compared to U.S. Environmental Protection Agency (EPA) drinking water standards (for cadmium and cyanide) or EPA secondary drinking water standards and other health-based information (for TDS and sulfate, which lack health-based standards). The protectiveness of these standards or guidelines was reviewed in my expert report.

9. My updated review of the scientific literature and regulatory standards and guidance for the constituents of concern has yielded no substantive changes in my original opinion. The EPA maximum contaminant levels (MCLs) and secondary MCLs for these constituents in drinking water have not changed and the current scientific literature indicates that use of these values to screen for possible human health concerns is a health-protective approach.

10. I updated this comparison of criteria to include the more recent monitoring data up to October 2007. Inclusion of the more recent data does not change my original conclusion that exposure to Wulik River water would not be a health concern.

11. The more recent data were, overall, similar to previous sample results for cyanide (both total cyanide and weak-acid dissociable [WAD] cyanide) and cadmium. After incorporation of the recent data, the average levels for cyanide (sampled only at Station 2) and cadmium at Stations 1 and 2 from 1998 to 2007 decreased slightly (Table 1). The maximum values for cyanide were unchanged. The maximum for cadmium at Station 1 increased slightly because one sample in August 2006 had a higher concentration ( $4.9 \mu\text{g/L}$ ) than measured before at this station, even though all other samples in this recent data set were low and near or below detection limits. Nevertheless, this concentration is still below the MCL for cadmium in drinking water. The recent data set for Station 2, which is upstream and much closer to the mine, did not show elevated results over previous years; cadmium discharge violations have not been alleged in recent years. Therefore, this isolated new maximum result does not appear to be related to discharge from the mine, nor does it indicate a health concern.

12. Thiocyanate levels were not available in Wulik River samples as part of the regular monitoring data; however, data from the outfall from the mine on Red Dog Creek in 2005 through 2007 indicate levels that ranged from undetectable ( $<1.0$  mg/L) to 3.6 mg/L. Compared to the U.S. EPA (2004) Region 9 preliminary remediation goal (PRG) for thiocyanate in residential drinking water (1.8 mg/L), these levels measured at the outfall are expected to result in levels in the Wulik River that are far below this screening level, because of the large amount of dilution that would transpire over this distance. Thiocyanate was undetectable ( $<0.5$   $\mu$ g/L) in a sample of Wulik River water at Station 1 dated August 2005.

13. For TDS and sulfate, the overall average and maximum sample values increased for Stations 1 or 2; however, the overall average as well as the vast majority of sample results are well below the secondary MCLs for these constituents, and even farther below levels that might result in health effects, as explained in my expert report. Maximum sample values for TDS and sulfate increased with the inclusion of the sample data from 2005 through 2007, and were above their respective secondary MCLs (500 mg/L and 250 mg/L) at Station 2, but were still well below their secondary MCLs at Station 1 where exposure is more likely (Table 1).

14. Exceedances of the secondary MCLs at Station 2 were occasional. For TDS, 4 of 22 samples in 2005 (640, 560, 1,100, and 829 mg/L in February, March, March, and December, respectively), 2 of 18 samples in 2006 (540, 610 mg/L in February and March, respectively), and no samples in 2007 exceeded the secondary MCL for TDS. For sulfate, only 2 of 22 samples in 2005 (288 and 281 mg/L in March and December) and none in 2006 or 2007 exceeded its secondary MCL. These samples that exceeded the secondary MCLs were collected at times of the year when water flows would be low on the Wulik and other rivers. At these times, the mine

would not be discharging water from snowmelt or rainfall (in spring and summer) nor would the Village of Kivalina be drawing water from the Wulik River (occurs in late summer). As explained in my expert report, secondary MCLs are not health-based, and much higher levels of these constituents are required before even relatively benign health impacts (acute laxative effects in non-acclimated individuals) would occur. Thus, no potential for health effects is indicated by the sample data for these constituents as well.

#### **B. Kivalina Drinking Water**

15. Additional drinking water samples for the Village of Kivalina from March and September 2005, October 2006, and October 2007 were available for my review. The data set also included water samples from Station 1 on the Wulik River dated August 2005. As before, cadmium, total cyanide, and WAD cyanide were all largely undetectable and well below drinking water standards. Thiocyanate was also undetectable at detection limits that were well below the EPA Region 9 PRG for thiocyanate in drinking water. TDS levels were generally similar among the Kivalina drinking water and Wulik River water samples, and were approximately half of the secondary MCL for TDS. Approximately 25–30 percent of the TDS concentration was sulfate, which was therefore well below the secondary standard for odor and taste, and the higher advisory level proposed by EPA for potential concern for laxative effects of sulfate, as noted in my expert report.

16. A large number of other organic and inorganic constituents were analyzed in the Kivalina and Wulik River Station 1 samples. None of these results indicated exposures from the mine that might be a health concern.

17. Thus, the recent Kivalina drinking water samplings are consistent with the earlier sampling, which indicated no evidence of health concern as a result of the alleged discharge monitoring violations.

### C. Biota

18. Additional fish tissue samples of adult Dolly Varden from the Wulik River at Station 2 were collected and analyzed for metals by the ADNR and ADF&G in spring and fall 2004, 2005, and 2006. These samples supplement the data from 1998 through 2003, which were evaluated in my expert report. Of the substances involved in this case, cadmium tissue concentrations were evaluated; the other named constituents, TDS and cyanide, were not analyzed, because as noted in my expert report, these constituents are not a concern for accumulation in fish tissue, nor for food-chain risks to humans at the levels present in Wulik River water. As before, cadmium in fish muscle tissue was undetectable in all samples. Cadmium was detected in fish liver and other organs (e.g., kidney, reproductive organs) that may be eaten by local tribal people. The maximum cadmium concentration in liver and kidney samples over the 1998 to 2006 time period is the same as reported in my expert report and sample averages for this time period decreased slightly. The adult Dolly Varden fish sample data were also reported by Ott and Morris (2007). Ott and Morris (2007) note that cadmium and other metals do not concentrate in muscle tissue and imply that cadmium concentrates preferentially in kidney tissue. In describing cadmium kidney tissue data, Ott and Morris (2007) state, "[o]ver the last three years, Cd concentrations have been stable and lower than those reported previously" (Figure 1). Therefore, my previous conclusion remains unchanged;

cadmium concentrations in fish tissues samples are relatively low and do not indicate a human health concern.

19. Sampling by Maniilaq Association (reported by Scannell 2005 and Rudnick 2005) indicate similar results for samples of adult Dolly Varden collected from the Wulik River near Kivalina (7 in July 2004 and 5 in February 2005) and submitted for tissue analysis of selected metals (Scannell 2005). Seven fish were collected in February 2005 and submitted for whole body analysis of these metals. Dolly Varden samples were also taken from the Noatak River as a comparison. Cadmium levels in Wulik River and Noatak River fish muscle tissue were undetectable in all samples. Cadmium levels in other organs potentially eaten (e.g., liver and kidney samples) were similar between Wulik and Noatak River, given the small sample size and sample variation. Scannell (2005) concluded that these cadmium levels were 1/100 of levels considered to cause harm in fish. Overall, Scannell (2005) reported that metals concentrations in the Wulik and Noatak fish samples were similar and do not exceed fish tissue levels reported in nationwide studies or studies of fish from other parts of Alaska.

20. Thus, these additional fish tissue data continue to indicate a lack of evidence of potential harm from the constituent of concern in this case.

21. Bearded seals are noted as an important subsistence resource for local populations and were studied by ADF&G because of their potential to accumulate metals from feeding on prey that may take up metals released as a result of mine operations (Quakenbush and Citta 2006). ADF&G (Quakenbush and Citta 2006), however, found no significant differences

between cadmium concentrations in bearded seal tissues collected near the village of Kivalina from those in bearded seal tissues collected from control sites.

**E. Biomonitoring**

22. In November 2004, the Alaska Division of Public Health (ADPH) collected blood samples from 10 individuals from Kivalina and 48 individuals from Noatak and analyzed them for lead and cadmium (Middaugh and Arnold 2005). Samples from both villages were below levels of health concern and did not appear to differ. ADPH noted that “[t]he results provide additional evidence that the villages of Kivalina and Noatak are not being exposed to lead or cadmium from mining operations.” ADPH also noted that because of the few individuals who volunteered from Kivalina, the results for this village must be interpreted with caution.

**F. Summary**

23. Available site data show no evidence of a human health concern as a result of the permit violations for discharges at the mine alleged in the complaints.

**V. Exhibits Supporting Opinions**

Exhibits supporting or summarizing my opinions are included as Attachment B. The exhibits are as follows:

- Table 1. Summary of Wulik River 1998–2007 monitoring data (Stations 1 and 2) for cadmium, cyanide, TDS, and sulfate.

- Figure 1. Figure 104 from Ott and Morris 2007. Median, maximum, and minimum concentrations of Cd (dry-weight) in Dolly Varden kidney tissue (1982 and 1999 to 2006).

I may change the format of the information depicted in the above exhibits, use additional information drawn from the materials considered in forming my opinions, and/or use additional exhibits at trial.

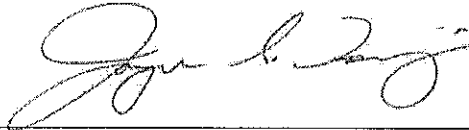
#### **VI. Compensation**

24. Dr. Tsuji is employed at Exponent, Inc. The company is being compensated at the rate of \$300 per hour of Dr. Tsuji's time spent preparing her opinions.

#### **VII. Other Testimony**

I have not given any recent testimony to add to that listed in my November 2004 expert report.

EXECUTED this 18th day of January 2008 at Bellevue, Washington.

A handwritten signature in cursive script, appearing to read "Joyce S. Tsuji", written over a horizontal line.

Joyce S. Tsuji